CHINA
Year 4 (October 2017-September 2018)

Implementing Partners: EcoHealth Alliance (EHA), Wuhan Institute of Virology, Chinese Academy of Sciences (WIV), Institute of Microbiology, Chinese Academy of Sciences (IMCAS), Yunnan Institute of Endemic Diseases Control and Prevention (YIEDC), and Guangdong Provincial Institute of Public Health, Guangdong CDC (GDIPH)
Country Coordinator: Dr. Zhengli Shi, WIV
Global Point of Contact: Hongying Li, EHA

Partners
- Affiliated Hospital of Dali College, Yunnan Province
- College of Life Sciences, Guangxi Normal University
- Food and Agricultural Organization (FAO) China Emergency Center for Transboundary Animal Diseases (ECTAD) Office
- Guangdong Institute of Applied Biological Resources
- Guangxi Center for Disease Control and Prevention (Guangxi CDC)
- *Institute of Pathogen Biology, Chinese Academy of Medical Sciences (IPBCAMS)
- Institute of Pathogenic Microbiology, Guangdong Center for Disease Control and Prevention (Guangdong CDC)
- Medical School of Shantou University, Guangdong Province
- National Institute for Viral Disease Control and Prevention, China Center for Diseases Control and Prevention (China CDC)
- People's Hospital of Chuxiong Prefecture, Yunnan Province
- People's Hospital of Dali Prefecture, Yunnan Province
- School of Life Sciences, East China Normal University (ECNU)
- *South Agricultural University, Guangdong Province
- The First Affiliated Hospital of Shantou University, Guangdong Province
- The Second Affiliated Hospital of Shantou University, Guangdong Province
- The Third People's Hospital of Kunming, Yunnan Province
- Tungwah Hospital, Dongguan, Guangdong Province
- USAID Regional Development Mission Asia
- Yunnan Center for Disease Control and Prevention (Yunnan CDC)
*Partnership in development

Prevent and Detect Zoonotic Disease

PREDICT builds the workforce, strengthens systems, and conducts zoonotic disease surveillance for priority zoonotic diseases and other emerging threats. In China, PREDICT is putting One Health in action by integrating animal and human

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health sectors from the national to district level through the collection and testing of samples from animals and humans. PREDICT builds partnerships at national, provincial and local levels to bolster mechanisms for responding to zoonotic disease threats. Our data and findings on priority zoonotic diseases, emerging threats, and human activities and behaviors catalyze interministerial communication and data sharing and support improved coordination among national surveillance and detection networks. We plan to continue zoonotic disease surveillance for priority diseases and emerging threats and will work to optimize viral detection assays to distinguish high priority viruses including SARS-like coronavirus, MERS-like coronavirus, filoviruses, flaviviruses, henipaviruses, and bunyaviruses viruses. We also plan to conduct expanded characterization of viruses identified under PREDICT-1 (in wildlife and humans) from key viral families (coronaviruses, paramyxoviruses, filoviruses, flaviviruses, and influenza viruses. Livestock surveillance activities in collaboration with FAO, planned for Guandong Province, are pending approval by the Ministry of Agriculture.

Where we work

Yunnan Province is bordered by Vietnam, Laos, and Myanmar and is the most biologically and culturally diverse province in China. With a large population of humans living in rural areas and in close contact with wildlife, there are a diversity of human-animal interfaces including wildlife trade, hunting, and consumption both locally and across national borders. Two surveillance sites were selected in Yunnan Province: **1) Jinning**, in central Yunnan, where PREDICT teams discovered SARS-like coronavirus in bats roosting in caves proximate to rural communities; and **2) Xishuangbanna**, in southwestern Yunnan, part of the upper Mekong river basin area which harbors a large diversity of animals including bats. Different ethnic minorities reside in rural areas near bat caves. Hunting and consumption of wildlife is part of the traditional cultures in this region. Bat samples were collected from Jinning and Xishuangbanna in PREDICT 1 and 2, with positive results confirmed for coronaviruses and paramyxoviruses.

Guilin, Guangxi Province is in southern central China on the border with Viet Nam. People living in this rural area visit bat caves for hunting and guano collection as well as mountains to capture wild animals for farming (i.e. bamboo rats, civets) and consumption (i.e. bats). Wildlife is a highly desirable food among local people, and there is a large network of wild animal trade in the region. Bat samples were collected from Guilin in PREDICT 1 and 2 with positive results confirmed for coronaviruses and paramyxoviruses.

Dongguan, Guangdong Province is in the southeast of China where the earliest cases of SARS occurred due to human-animal contact along wildlife trade routes and in markets. Dongguan is a rapidly urbanizing city with large

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human movements. There is a long history of wildlife consumption in Dongguan and it has become one of the main destinations of traded wild animals from other provinces and countries.

Zoonotic Disease Surveillance Sites

- **Jinning, Yunnan Province:** Crop production, human dwellings or temporary settlements, markets and value chains, natural areas
  - Sampling targets:
    - Wildlife: Bats and rodents roosting in/nearby human dwellings and settlements, cropland, and that are hunted for trade or consumption
    - Community human behavioral (qualitative and quantitative) surveillance among populations who live and work near wild animal roosts and who hunt, trade, or consume wild animals
    - Human syndromic surveillance at local clinics and hospitals

- **Dongguan, Guangdong Province:** Human dwellings or temporary settlements, markets and value chains, natural areas, animal production
  - Sampling targets:
    - Wildlife: Bats and rodents roosting in/nearby human dwellings and settlements, cropland, and that are hunted for trade or consumption
    - Community human behavioral (qualitative and quantitative) surveillance among populations who live and work near wild animal roosts and who hunt, trade, or consume wild animals
    - Human syndromic surveillance at local clinics and hospitals

- **Xishuangbanna, Yunnan Province:** Crop production, human dwellings or temporary settlements, markets and value chains, natural areas, animal production
  - Sampling targets:
    - Wildlife: Bats and rodents roosting in/nearby human dwellings and settlements, cropland, and that are hunted for trade or consumption
    - Community human behavioral (qualitative and quantitative) surveillance among populations who live and work near wild animal roosts and who hunt, trade, or consume wild animals

- **Guilin, Guangxi Province:** Crop production, human dwellings or temporary settlements, markets and value chains, natural areas, animal production
  - Sampling targets:
    - Wildlife: Bats and rodents roosting in/nearby human dwellings and settlements, cropland, and that are hunted for trade or consumption

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- Community human behavioral (qualitative and quantitative) surveillance among populations who live and work near wild animal roosts and who hunt, trade, or consume wild animals

Strengthening Laboratory Systems

PREDICT supports the development of an integrated One Health laboratory network by engaging the Wuhan Institute of Virology of the Chinese Academy of Sciences (animal and human testing) and the Institute of Pathogenic Microbiology of Guangdong Center for Disease Control and Prevention (human testing). This year, PREDICT plans to engage two additional labs, the Institute of Microbiology of the Chinese Academy of Sciences (animal testing) and the Yunnan Institute of Endemic Disease Control and Prevention (animal and human testing). Advanced pathogen characterization of prioritized viruses (full genome sequencing, virus isolation, etc.) will be conducted at the Wuhan Institute of Virology and the Institute of Microbiology as needed. We will continue to provide technical support for viral detection of in-country partner labs and will keep developing partnerships and seeking opportunities to deploy viral detection protocols in other laboratories to improve capabilities to detect known and emerging viral threats. In addition, we plan to optimize assays to distinguish high-priority viruses including SARS-like and MERS-like coronaviruses, filoviruses, flaviviruses, henipaviruses, bunyaviruses, and influenza viruses; expand viral characterization of viruses identified in PREDICT-1 in wildlife and humans from priority viral families; and improve laboratory and field standard operating procedures such as cold chain, receiving specimens, biosafety, and biosecurity.

Animal lab(s): Wuhan Institute of Virology of the Chinese Academy of Sciences, with training and transfer of protocols at the Institute of Microbiology of the Chinese Academy of Sciences and the Yunnan Institute of Endemic Disease Control and Prevention
- Viral families planned for testing: corona, filo, influenza, paramyxo, flavi, and bunya viruses

Human lab(s): Wuhan Institute of Virology of the Chinese Academy of Sciences and the Institute of Pathogenic Microbiology of Guangdong Center for Disease Control and Prevention, with training and transfer of protocols at Yunnan Institute of Endemic Disease Control and Prevention
- Viral families planned for testing: corona, filo, influenza, paramyxo, flavi, and bunya viruses

Workforce Development and Improving Real-time Surveillance

PREDICT provides training opportunities to strengthen the One Health workforce in China, as government staff from district to national levels are engaged in

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implementation of zoonotic disease surveillance and detection activities. Project data and findings on zoonotic diseases and enabling behaviors underlying transmission are shared and communicated through established channels with ministry partners across animal and human health sectors, strengthening data platforms and improving the ease of dissemination of animal, human, epidemiological, and ecological data. We will continue discussions with government, universities, NGOs, laboratories, hospitals and other partners to evaluate potential collaborations for human and animal surveillance and viral detection. In addition and at request of government partners, PREDICT provides support during outbreaks for planning, logistics, field investigation, sampling, and diagnostic testing.

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EGYPT
Year 4 (October 2017-September 2018)

Implementing Partners: EcoHealth Alliance (EHA), Human Link, Egypt National Research Centre (NRC) Center of Scientific Excellence for Influenza Viruses (CSEIV), Egypt Ministry of Agriculture and Land Reclamation
Country Coordinator: Dr. Mohamed Ali, Egypt National Research Centre (NRC)
Global Point of Contact: Patrick Dawson, EcoHealth Alliance

Partners
- Egypt Ministry of Agriculture and Land Reclamation
- Egypt Ministry of Health
- Egypt Ministry of Higher Education (National Research Center)
- Food and Agriculture Organization of the United Nations (FAO)
- USAID EPT One Health Workforce
- USAID/Egypt

Prevent and Detect Zoonotic Disease

PREDICT strengthens One Health partnerships and conducts zoonotic disease surveillance activities by sampling wildlife and people and conducting behavioral risk investigations at high-risk interfaces for zoonotic disease transmission. This work directly supports the national surveillance system and provides opportunities to strengthen the mechanisms for responding to zoonotic diseases, including priority zoonotic diseases such as avian influenza virus, Middle East Respiratory Syndrome (MERS) Coronavirus, and other emerging viral threats. In addition, PREDICT supports the development of Egypt's One Health workforce by training and engaging government staff in surveillance and disease detection activities. PREDICT/Egypt conducts concurrent biological and behavioral surveillance targeting bats and people at high-risk camel-human interfaces identified by ministry partners as important sites along the camel value chain.

Where we work

PREDICT/Egypt collaborates with ministry partners and FAO to conduct zoonotic disease surveillance along the camel value chain (e.g., abattoirs, live animal markets, farms). PREDICT is investigating zoonotic disease transmission risk at high-risk interfaces targeting humans, bats, and camels at three main sites.

The camel value chain in **Greater Cairo** (Al Qalyubia, Banha, Basateen, El Mansoria, El Shohada, Toukh) includes camel markets, camel abattoirs, and small farms. The markets also attract tourism and have nearby natural areas

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where bats may reside. Dromedary camel herds in Greater Cairo are known to have evidence of infection with MERS coronavirus.

The camel value chain in **Greater Giza** (Birqash, Kurdasa, Nahia, Warraq) includes camel markets and camel abattoirs. The markets also attract tourism and have nearby natural areas where bats may reside. Dromedary camel herds in Greater Giza are also known to have evidence of infection with MERS coronavirus.

Marsa Matruh is the site of a government camel farm along the Mediterranean coast where humans regularly interact with camels, another key interface for targeted zoonotic disease surveillance activities.

Zoonotic Disease Surveillance Sites

- **Greater Cairo**
  - Sampling targets:
    - Wildlife: bats
    - Livestock: camels with sampling supported by FAO
    - Community surveillance of at-risk human populations at camel markets and farms

- **Greater Giza**
  - Sampling targets:
    - Wildlife: bats
    - Livestock: camels with sampling supported by FAO
    - Community surveillance of at-risk human populations at camel markets and farms

- **Masra Matruh**
  - Sampling targets:
    - Wildlife: bats
    - Livestock: camels with sampling supported by FAO
    - Community surveillance of at-risk human populations at camel markets and farms

Strengthening Laboratory Systems

PREDICT engages and directly supports the national laboratory system in Egypt through our partner lab at the Center of Scientific Excellence for Influenza Viruses, part of the Egyptian National Research Centre in Giza. CSEIV has existing capability to detect both priority zoonotic diseases and emerging viral threats and supports zoonotic disease detection in both the human and animal health sectors.

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Animal and human lab: Center of Scientific Excellence for Influenza Viruses (CSEIV), Egypt National Research Centre
- Viral families planned for testing: filo, corona, influenza, paramyxo and flavi viruses

Operationalizing One Health and Capacity Strengthening Plans

PREDICT provides training opportunities to strengthen One Health workforce capacity in Egypt, as government staff participate in zoonotic disease surveillance and disease detection activities and use these opportunities to obtain in-service training in One Health skills and techniques. Upon invitation, PREDICT also supports outbreak response and preparedness. These investments are helping support the operationalization of the One Health approach in Egypt by providing critical linkages between animal and human health sectors. Data sharing and communication processes were established with the government further improving communications and multisectoral information flows.

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JORDAN
Year 4 (October 2017-September 2018)

Implementing Partners: EcoHealth Alliance (EHA) and Jordan University of Science and Technology (JUST)
Country Coordinator: Dr. Ehab Abu-Basha, JUST
Global Points of Contact: Dr. William Karesh and Patrick Dawson, EHA

Partners
- Food and Agriculture Organization of the United Nations (FAO)
- Jordan Ministry of Agriculture (MOA)
- Jordan Ministry of Environment (MOE)
- Jordan Ministry of Health (MOH)
- Princess Haya Biotechnology Center/JUST
- The Hashemite Fund for Development of Jordan Badia
- The Royal Society for the Conservation of Nature (RSCN)
- USAID/Jordan
- World Health Organization (WHO)
- World Organization for Animal Health (OIE)

Prevent and Detect Zoonotic Disease

PREDICT strengthens One Health partnerships and conducts zoonotic disease surveillance activities by sampling wildlife and people and conducting behavioral risk investigations at high-risk interfaces for zoonotic disease transmission. This work directly supports the national surveillance system and provides opportunities to strengthen the mechanisms for responding to zoonotic diseases, including priority zoonotic diseases such as avian influenza virus, Middle East Respiratory Syndrome (MERS) Coronavirus, and other emerging viral threats. In addition, PREDICT supports the development of Jordan's One Health workforce by training and engaging government staff in surveillance and disease detection activities. PREDICT/Jordan conducts concurrent biological and behavioral surveillance targeting bats and people at high-risk camel-human interfaces identified by ministry partners as important sites along the camel value chain.

Where we work

PREDICT/Jordan collaborates with ministry partners and FAO to conduct zoonotic disease surveillance along the camel value chain (e.g., abattoirs, live animal markets, farms). PREDICT is investigating zoonotic disease transmission risk at high-risk interfaces targeting humans, bats, and camels at three main sites.

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Northern Jordan near the Jordanian-Syrian border has a Mediterranean climate with some areas having an arid desert climate. The camel value chain through Northern Jordan (Ajlun, Ramtha) includes camel production sites and camel abattoirs. Camel herds in the area have been found to have MERS virus. There are many animal production and crop production sites in Northern Jordan, as well as numerous natural areas with bats, and there have been MERS-positive dromedary camels detected in Northern Jordan.

Middle Jordan possesses a Mediterranean climate and includes sites near Amman, the capital city and largest population center. There are farmlands, natural areas, peri-urban, and urban areas. The camel value chain through Middle Jordan (Azraq, Mafraq) includes camel production sites and camel abattoirs. The first known human cases of MERS were in Middle Jordan, and there have been camel herds in Middle Jordan with MERS virus.

Southern Jordan is largely characterized by an arid desert climate, although with a Mediterranean climate along the Red Sea. The camel value chain through Southern Jordan (Wadi Araba, Wadi Rum, Petra, Karak, and Aqaba) includes camel production sites; camel abattoirs; and major tourist attractions.

Zoonotic Disease Surveillance Sites

- **Northern Jordan**
  - Sampling targets:
    - Wildlife: bats
    - Livestock: camels with sampling supported by FAO
    - Community surveillance of at-risk human populations at camel markets and farms

- **Middle Jordan**
  - Sampling targets at location:
    - Wildlife: bats
    - Livestock: camels with sampling supported by FAO
    - Community surveillance of at-risk human populations at camel markets and farms

- **Southern Jordan**
  - Sampling targets (as budget allows):
    - Wildlife: bats
    - Livestock: camels with sampling supported by FAO
    - Community surveillance of at-risk human populations at camel markets and farms

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Strengthening Laboratory Systems

PREDICT engages and directly supports the national laboratory system in Jordan through our primary partner lab, the JUST Faculty of Veterinary Medicine (Diagnostic Lab at the Veterinary Health Center and Virology Lab). JUST has existing capability to detect both priority zoonotic diseases and emerging viral threats in both human and animal samples. In addition, the Princess Haya Biotechnology Center is conducting genome sequencing and confirmatory testing.

Animal and human lab: JUST Faculty of Veterinary Medicine (Diagnostic Lab at the Veterinary Health Center and Virology Lab)
- Viral families planned for testing: filo, corona, influenza, paramyxo and flavi viruses

Workforce Development and Improving Real-time Surveillance

PREDICT provides training opportunities to strengthen One Health workforce capacity in Jordan, as local staff participate in zoonotic disease surveillance activities and use these opportunities to obtain in-service training in One Health skills and techniques, and trainings and capacity building opportunities are frequently offered to ministry partners. PREDICT also contributes technical expertise on zoonotic disease surveillance by participating in monthly One Health meetings with focal points from MOH, MOA, MOE, RSCN, The Hashemite Fund for Development of Jordan Badia, USAID/Jordan, and WHO. Upon request by (and when approved by the PREDICT Management Team) PREDICT/Jordan stands ready to support outbreak response and preparedness. Data sharing and communication processes were established with the government partners, further improving communications and information flows between animal and human health sectors.

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MALAYSIA
Year 4 (October 2017-September 2018)

Implementing Partners: EcoHealth Alliance (EHA) and Conservation Medicine, Ltd.
Country Coordinator: Tom Hughes, Conservation Medicine, Ltd.
Global Point of Contact: Dr. Jon Epstein, EHA

Partners
- Danau Girang Field Center
- Department of Veterinary Services (Ministry of Agriculture) (DVS)
- Department of Wildlife and National Parks (PERHILITAN/DWNP)
- District Health Office Gua Musang
- District Health Office Kuala Kangsar
- District Health Office Kuala Lipis
- Ministry of Health (MoH)
- National Public Health Laboratory (NPHL)
- National Public Health Laboratory, Sabah
- Queen Elizabeth Hospital, Sabah (QEH)
- Sabah State Health Department, Sabah (SSHD)
- Sabah Wildlife Department (SWD)
- *Universiti Malaysia Sabah
- Universiti Putra Malaysia - Faculty of Veterinary Medicine (UPM)

*Partnership in development

Prevent and Detect Zoonotic Disease

PREDICT builds the workforce, strengthens systems, and conducts surveillance for priority zoonotic diseases and other emerging threats. In Malaysia, PREDICT puts One Health in action through zoonotic disease surveillance sampling wildlife and people and conducting behavioral risk investigations at high-risk human-animal transmission interfaces. This work directly supports the national surveillance system and provides opportunities to strengthen mechanisms for responding to priority zoonotic diseases and emerging threats. In addition, PREDICT supports the development of Malaysia's One Health workforce through field and lab-based training and engagement of national staff, university and NGO partners, and students in surveillance and disease detection activities. This year, PREDICT/Malaysia plans to conduct zoonotic disease surveillance activities targeting animals and humans in indigenous communities in Peninsular Malaysia with high level of contact with wildlife, livestock and domestic animals and to evaluate opportunities for expansion of activities for in-depth targeted and longitudinal surveillance. In addition, we plan to continue Deep Forest project surveillance in Sabah, sampling wildlife along a deforestation gradient and comparing viral diversity in bats, rodents, and nonhuman primates from each zone in Kinabatangan and Beluran Districts. Sampling at our Deep Forest sites is

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conducted concurrently with syndromic hospital surveillance at the main referral hospital for Sabah.

Where we work

Sabah, Malaysia, located on the island of Borneo, is a highly biodiverse area. It is also under extensive pressure from land-use changes, with drastic changes occurring over the past several years. Kinabatangan and Beluran Districts in Sabah are highly biodiverse areas under extensive pressure from land-use change, while also containing pristine reserves. In addition, there are several high-risk, human-animal interfaces including hunting, wildlife trade and consumption, and ecotourism. PREDICT is specifically investigating Gomontong caves in the Kinabatangan area, caves with large numbers of bats and also government regulated bird nest harvesting, which attracts ecotourism visitors who are directly exposed to bat guano while viewing the bird nest harvests. These caves are located in the Gomantong Forest Reserve, a virgin forest reserve, also home to several species of non-human primates. Queen Elizabeth Hospital (QEH) in Kota Kinabalu, Sabah is the main referral hospital for patients from across Sabah with undiagnosed illnesses. Syndromic surveillance at QEH will allow for concurrent hospital sampling across Deep Forest, as well as sampling throughout Sabah.

Peninsular Malaysia: Gua Musang , Kuala Kangsar and Kuala Lipis Districts are districts in Peninsular Malaysia contain communities of the indigenous Orang Asli. The Orang Asli have high levels of exposure to wildlife (e.g., as hunters, wildlife market vendors, and consumers). We have identified sites in Peninsular Malaysia with Orang Asli communities where individuals come into direct or indirect contact with wildlife through hunting, wildlife trade, residential contact, and other potential exposures. These communities are remote and have little access to regular health services, resulting in undiagnosed illnesses.

Zoonotic Disease Surveillance Sites

- **Gua Musang, Kuala Kangsar, and Kuala Lipis Districts on Peninsular Malaysia**: All three communities are concurrent sites for humans, domestic animals, and wildlife. Depending on wildlife capture results, we may select two of the communities for more intensive animal sampling to ensure these locations meet the requirements for concurrent sampling, while the third site will be re-classified as an independent sampling site.
  - Sampling targets: Humans, bats, rodents, small mammals, NHPs, hunting dogs, poultry and other livestock kept by these communities. These are the animals these communities share their homes with, eat, rear and hunt with.

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- **Sabah (including Kinabatangan and Beluran Districts – Deep Forest sites)**
  - Sampling targets:
    - Wildlife: bats, rodents, small mammals, non-human primates across land-use disturbance gradients in areas suspected to be at increased risk for human-animal contact.
    - Behavioral risk investigations at Gomantong caves, a site of ecotourism and swiftlet nest harvesting, leading to regular human presence at this interface
    - Syndromic surveillance of patients with diseases of unknown origin (especially with severe acute respiratory infections, acute encephalitis, and influenza-like illnesses that have tested negative for influenza).

- **Independent sites:** Conflict wildlife: limited opportunistic sampling of wildlife involved in trade, conflict with humans, or other risk interfaces.
  - Sampling targets:
    - Bats, rodents, small mammals, NHPs

- **Sabah (collaborative UMS sample testing):** This activity will involve screening wildlife samples collected under a separate but aligned study at UMS. Samples were collected using PREDICT methodology as part of a data sharing agreement and will be tested for our five priority viral families.
  - Sampling targets: <mark>bats roosting</mark> at high-risk interfaces for human and animal contact, including caves near settlements

Strengthening Laboratory Systems

PREDICT directly supports the development of a One Health national laboratory system in Malaysia by engaging the National Public Health Laboratory Peninsular Malaysia, at the new PERHILITAN National Wildlife Forensic Laboratory, the Sabah Wildlife Department Wildlife Health, Genetic and Forensic Laboratory, and the UPM Faculty of Veterinary Medicine for livestock and domestic animal screening. Staff at all labs receive training in techniques required for detection of priority zoonotic diseases and emerging threats, and are in communication with our global One Health laboratory network for technical assistance as needed. In collaboration with EPT and government partners, PREDICT also fosters communication and coordination between these animal and human labs and ministries, provides joint training exercises and routine information exchanges among lab managers, technicians, and ministry focal points, communicates data and findings to inform surveillance, and works to transfer knowledge and disease detection capacity to other labs in the national system.

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Will share PREDICT protocols with Public Health Lab Kota Kinabalu Sabah for syndromic surveillance and Universiti Malaysia Sabah for wildlife screening.

Animal labs:

PERHILITAN National Wildlife Forensic Laboratory
- Continued wildlife testing targeting: flavi, corona, influenza, filo and paramyxo viruses

UPM Faculty of Veterinary Medicine
- Continued livestock and domestic animal testing targeting: flavi, corona, influenza, filo and paramyxo viruses

SWD Wildlife Health, Genetic and Forensic Laboratory
- Continued wildlife testing targeting: flavi, corona, influenza, filo and paramyxo viruses
- Deep Forest Herpes testing on hold while we review current data

Universiti of Malaysia Sabah (UMS) Laboratory
- Continued wildlife testing targeting: flavi, corona, influenza, filo and paramyxo viruses
- Testing of bat and other priority samples collected using PREDICT protocols at high-risk interfaces.

Human labs:

National Public Health Laboratory Peninsular Malaysia
- Continued human testing targeting: corona, influenza, filo and paramyxo viruses

Public Health Laboratory Kota Kinabalu Sabah
- Continued human testing targeting: flavi, corona, influenza, filo and paramyxo viruses

Workforce Development and Improving Real-time Surveillance

PREDICT provides critical hands-on and on-the-job training to strengthen One Health workforce capacity in Malaysia for government staff, students, research institutes, and local communities. By providing opportunities to put One Health in action across the full spectrum of skills required for safe and effective zoonotic disease surveillance, PREDICT strengthens Malaysia's capacity to sample animals and people, investigate behaviors associated with zoonotic disease transmission, detect priority zoonotic diseases and emerging threats, and perform data analyses to understand zoonotic disease risks. National One Health focal points and local government staff have been, and will continue to be,

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involved in field surveillance activities, and we will continue to engage with them to ensure the operationalization of the One Health approach. In addition, PREDICT engages in regular discussions and strategy meetings regarding wildlife, human and livestock surveillance, biosafety, lab management, risk assessments and sample collection and testing with MoH, DWNP, DVS, SWD, and SSHD. Data sharing and communication processes were established with the government through Zoonosis Technical Working Committee during PREDICT-1. These processes will also be expanded to other government partners as appropriate to strengthen data platforms and improve the ease of dissemination of relevant animal, human, epidemiological, and ecological data. Finally, when requested by the government (and approved by PREDICT management team) PREDICT provides outbreak preparedness and response support.

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REPUBLIC OF CONGO
Year 4 (October 2017-September 2018)

Implementing Partners: EcoHealth Alliance with Laboratoire National de Santé Publique (LNSP) Brazzaville and Laboratoire de Diagnostic Vétérinaire Brazzaville (LNVB)
Country Coordinator: TBN
Global Point of Contact: Dr. William Karesh (EHA)

Partners
- Head Office of Epidemiology and the Fight against Disease*
- Head Office of Livestock*
- Head Office of the Environment*
- Ministry of Agriculture and Breeding*
- Ministry of Health and Population*
- Ministry of National Defense*
- Ministry of Scientific Research and Technological Innovation*
- Ministry of Sustainable Development, Forestry and Environment*
- National Institute of Agronomic Research (INRA)*
  *Partnership in development

Prevent and Detect Zoonotic Disease

PREDICT strengthens One Health partnerships through zoonotic disease surveillance and behavioral risk investigations at high-risk interfaces for zoonotic disease transmission. This work directly supports the national surveillance system and provides opportunities to strengthen the mechanisms for responding to zoonotic diseases, including zoonotic diseases such as avian influenza virus, hemorrhagic fevers (Ebola, Marburg, etc.), and emerging viral threats. In addition, PREDICT supports the development of the Republic of Congo's (RoC) One Health workforce by training and engaging government staff in surveillance and disease detection activities. This year, PREDICT/RoC is focusing behavioral risk investigations in the Brazzaville area and conducting wildlife sampling (as feasible) in Sibiti, while targeting improvements in disease detection in the national laboratory system.

Where we work

Sibiti is located between Brazzaville and Pointe-Noire, and is a two square kilometer area with a population of about 20,000 people. Sibiti straddles the forest and plains of the Valley of the Niari, and along with surrounding towns is a central attraction and one of the largest purveyors of bushmeat in the area for the larger cities of Dolisie, Nkayi, Pointe-Noire, and Brazzaville. In addition to hunting, residents of Sibiti practice agriculture and livestock husbandry, as

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well as forestry and mining . Within Sibiti, two local extractive industry companies, Sicofor and Sciage Industriels Panneaux Moulures (SIPAM), employ over one hundred individuals each. Sibiti was selected for wildlife surveillance due to the presence of the mining and forestry industries, widespread hunting for consumption and trade, restaurants selling wildlife including rodents, bats, and gazelle, and markets that trade fresh and smoked bushmeat (rodents, bats, antelope, pangolin), as well as the close proximity of wildlife to humans (bats and rodents) in and around dwellings.

Brazzaville is the capital and one of the major urban areas in RoC. Brazzaville residents engage in small-scale agriculture, but a large portion of the local diet is derived from meat, both domestically cultivated and bushmeat either hunted or purchased at local wildlife markets (live for slaughter, fresh, or smoked). These markets are the specific target for behavioral risk investigations where we plan to examine the dynamics of bushmeat markets through interviews with key informants and through participant observation.

Zoonotic Disease Surveillance Sites

- **Sibiti area**
  - Sampling targets:
    - Wildlife: non-human primates, rodents and bats in and around human dwellings and agricultural fields, as feasible.

- **Brazzaville area**
  - Behavioral risk investigations at five bushmeat markets (Ouenze, Totale, Bourreau, Dragage, and Mikalou) and bushmeat restaurants in the greater Brazzaville area.

Strengthening Laboratory Systems

PREDICT engages and directly supports the national laboratory system in RoC through the Ministry of Health's Laboratoire National de Santé Publique (LNSP). To date, equipment and supplies have been transferred to the lab and plans going forward are to ensure that equipment is fully installed and operational (if feasible due to logistical concerns). We also plan to work with LNSP to strengthen capabilities for disease detection through the transfer of protocols and provision of training to lab staff, and to provide quality assurance and mentorship on test results (if produced).

Lab: Laboratoire National de Santé Publique (LNSP) for testing of wildlife samples
- Viral families planned for testing: corona, filo, influenza, paramyxo, and flavi viruses

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Workforce Development and Improving Real-time Surveillance

PREDICT provides training to strengthen One Health workforce capacity in RoC, as ministry and local staff gain access to opportunities for in-service training in One Health skills and techniques critical for safe and effective zoonotic disease surveillance. National One Health focal points and local government staff have been, and will continue to be involved in field surveillance activities, and we will continue to engage with them to ensure the operationalization of the One Health approach. PREDICT also builds in- country capacity for mixed methods behavioral science and analytics, by utilizing and refining the skill set of the in-country behavioral risk team. PREDICT supports the RoC inter-ministerial working group for emerging infectious diseases, and will utilize this mechanism for initial data sharing. When requested by the Government of RoC (and approved by the PREDICT Management Team), we stand ready to support outbreak response and preparedness.

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THAILAND
Year 4 (October 2017-September 2018)

Implementing Partners: EcoHealth Alliance
(EHA), WHO Collaborating Centre for Research and Training on Viral
Zoonoses, Chulalongkorn University
Country Coordinator: Supaporn Wacharapluesadee, Chulalongkorn
University Bangkok
Global Point of Contact: Kevin Olival and Alice Latinne, EHA

Partners
- Bureau of Disease Control and Veterinary Services, Department of
  Livestock and Development (DLD), Ministry of Agriculture and
  Cooperative
- Bureau of Emerging Infectious Diseases, Department of Disease Control,
  Ministry of Public Health (MOPH)
- Bureau of Epidemiology, Department of Disease Control, Ministry of
  Public Health
- Department of National Parks, Wildlife and Plant Conservation (DNP),
  Ministry of Natural Resources and Environment
- Faculty of Forestry, Kasetsart University
- Food and Agricultural Organization (FAO) of the United Nations
- National Institute of Animal Health, DLD
- The Monitoring and Surveillance Center for Zoonotic Diseases in Wildlife
  and Exotic Animals (MOZWE), Mahidol University
- US Department of Defense, DTRA-CBEP
- USAID EPT One Health Workforce
- USAID EPT Preparedness and Response
- USAID/RDMA

Prevent and Detect Zoonotic Disease

PREDICT builds the workforce, strengthens systems, and conducts surveillance
for priority zoonotic diseases and other emerging threats. In Thailand, PREDICT
puts One Health in action through zoonotic disease surveillance sampling wildlife
and people and conducting behavioral risk investigations at high-risk human-
animal transmission interfaces. This work directly supports the national
surveillance system, contributes to the development and implementation of the
national One Health platform, and provides opportunities to strengthen
mechanisms for responding to priority zoonotic diseases and emerging threats.
In addition, PREDICT supports the development of Thailand's One Health
workforce through field and lab-based training and engagement of national staff,
university and NGO partners, and students in surveillance and disease detection
activities. This year, PREDICT/Thailand is focusing zoonotic disease surveillance
activities at high-risk animal-human interfaces associated with land use change,

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wildlife consumption, resource extraction (guano), and indirect exposure to animal excreta. We also plan to collaborate with DTRA-CBEP to ensure efficiency of complimentary research and surveillance activities, including testing collaboratively collected samples using our viral family protocols and entering all data (site characterization, animal and specimen data, and test results) into the project database.

Where we work

Loei Province is a typical provincial rural area in the midst of land use conversion, as forest is cleared for production of rice, corn, and cassava. It is also the site of an active rodent trade and rodent consumption is common. We are actively working with the provincial hospital in Loei to conduct syndromic surveillance, which may allow us to detect viral spillover.

Ratchaburi Province is in the Western part of Central Thailand bordering Myanmar. Karst formations and caves are common, and our surveillance sites include caves where bat guano is collected by hand and sold for local agricultural production. Bats, rodents, and non-human primates are abundant at these sites that include tourist attractions. Betacoronavirus Group C (MERS-CoV group) was found in bat guano collected from this region in 2006.

Chonburi Province is in Central/Eastern Thailand where there is extensive swine production and mixed agricultural production. Large fruit bat colonies exist in this province where Nipah virus has been previously identified. Fruit bat foraging areas overlap with pig production sites, and the Buddhist temple that harbors bat populations is a local site of worship and tourist attraction. A local health promotion clinic, directly opposite a large fruit bat roost was the site for human community surveillance in Year 3.

Zoonotic Disease Surveillance Sites

- **Loei Povince, Northeastern Thailand at the Laos border (Xaignabouli and Vientiane Provinces)**
    - Sampling targets:
        - Wildlife: bats and rodents in/surrounding land conversion areas, human dwellings and markets
        - Syndromic surveillance of hemorrhagic and encephalitis patients from Loei hospital

- **Ratchaburi Province, Western Thailand**
    - Sampling targets:
        - Wildlife: bats, rodents and macaques cohabitating in the same area around the cave

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- Domestic animal sampling around bat roost temple and villages in collaboration with FAO and DLD (sites to be confirmed), and DTRA-CBEP
- Community surveillance of people working in bat guano fertilizer trade (miners, sellers, buyers, middle men, handling workers)

- **Chonburi Province, Central Thailand**
  - Sampling targets:
    - Wildlife: fruit bats in communities located near pig farms
    - Community surveillance of people living and working close to bat roosts

Strengthening Laboratory Systems

PREDICT directly supports the development of a One Health national laboratory system in Thailand by engaging the laboratory of the Chulalongkorn University Hospital, The Thai Red Cross Emerging Infectious Health Science Centre in Bangkok, Thailand. This lab is a national reference laboratory for diagnosis and confirmation of emerging infectious diseases in collaboration with Ministry of Public Health (MOPH). Viral detection protocols have also been shared with the National Institute of Animal Health laboratory (NIAH) and the Monitoring and Surveillance Center for Zoonotic Diseases in Wildlife and Exotic Animals (MOZWE), Mahidol University, and two staff members from each laboratory have been trained on their use. Samples collected from livestock through support from FAO are analyzed at NIAH laboratory. MOZWE is a FAO Reference Center for Wildlife and Zoonotic Diseases and will be using our viral detection protocols for wildlife surveillance. In addition, PREDICT provides technical support and works to foster communication and coordination between national animal and human labs and ministries through training and routine information exchanges, and communication of data and findings to inform surveillance.

Animal labs: WHO-CC for Research and Training on Viral Zoonoses, Chulalongkorn University, with training and transfer of protocols (in collaboration with FAO) to National Institute of Animal Health Laboratory (NIAH)
- Viral families planned for testing: corona, filo, influenza, paramyxo, and flavi viruses

Human lab: WHO-CC for Research and Training on Viral Zoonoses, Chulalongkorn University
- Viral families planned for testing: corona, filo, influenza, paramyxo, and flavi viruses and syndrome related viral families for clinical surveillance

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Workforce Development and Improving Real-time Surveillance

PREDICT provides critical hands-on and on-the-job training to strengthen One Health workforce capacity in Thailand by providing opportunities to put One Health in action across the full spectrum of skills required for safe and effective zoonotic disease surveillance. PREDICT strengthens Thailand's capacity to sample animals and people, investigate behaviors associated with zoonotic disease transmission, detect priority zoonotic diseases and emerging threats, and perform data analyses to understand zoonotic disease risks. In addition, PREDICT works across ministries and sectors supporting the National One Health Committee and development of the National One Health strategic plan. Data sharing mechanisms for PREDICT results were established with the government through the National One Health Committee improving communications and linkages across animal and human sectors by sharing data and findings on zoonotic diseases and the enabling behaviors underlying transmission. Finally, when requested by the Government of Thailand (and approved by PREDICT management team) PREDICT provides outbreak preparedness and response support.